8.0 DEVELOPMENT OF FEASIBLE ALTERNATIVES

8.1 Introduction

In this section, the alternatives for the Site are presented. The development is discussed along with the engineering factors that led to the alternatives. Detailed evaluation of the alternatives is discussed in Section 9.0.

As per the guidance for conducting feasibility studies under CERCLA (EPA 1988), the developed alternatives cover a range of options from no further action to containment to treatment (on-site and off-site). The process used in developing the alternatives considers 1) the type of contaminants in each source area, 2) the location of the impacted material (saturated or unsaturated zone) and 3) the matrix type (contaminated soil or chemical residue) to be remediated. In terms of defining alternatives, the unsaturated zone is defined as all material above the Primary Cohansey water table and includes the perched water zone above the Yellow Clay and the Yellow Clay. Table 8.1 lists the types and locations of materials relevant to the Site.

Types of contaminants refer to whether the major contaminants in the media to be remediated are organic or inorganic chemicals of concern (COCs). Different treatment and disposal alternatives are applicable to the two broad groups of contaminants. The focus in this FS has been on organics with respect to groundwater impact because impact from inorganics is minor.

Among the organic COCs, there are differences in treatability of the COCs by different technologies. For example, 1,2,3-trichloropropane is relatively non-biodegradable, such that biotreatment technologies are not applicable. For that compound, thermal treatment is effective. As another example, tetrachloroethene does not biodegrade under aerobic conditions. Anaerobic biotreatment or thermal treatment is effective for that compound. Both of those compounds, as well as all other COCs, are currently being controlled by hydraulic capture and removal in the groundwater treatment system.

The location of the material to be treated also determines the applicable alternatives. There are three (3) location criteria, 1) surface soils (material), 2) subsurface material in the unsaturated zone, as defined above, and 3) subsurface material in the saturated zone (below the water table). All material is considered for impact to groundwater.

Table 8.1

Classification of Material to be Remediated at the Site

Matrix Type	Unsaturated Zone		Saturated Zone	
	Organics	Inorganics	Organics	Inorganics
Sandy soils	X	X	X	
Clay soils	X		X	
LSD material		X		
Iron Filings material	X			
Debris	X	X		
Wastewater treatment solids	X	X		

Ex situ alternatives were not developed for the saturated zone due to the impracticability of excavation of that material. *Ex situ* remediation of materials below the water table involves engineering techniques that involve risk to workers and to the success of the remediation. Usually, if considerable benefit is not obtained by these operations, *in situ* methods are preferred. The delineation of contamination at depth is tenuous and knowing specifically where to remediate is uncertain. That leads to the use of techniques that are broader in area such as *in situ* bioremediation or hydraulic control and removal of contaminants.

The matrix type refers to the type of material contained within the zone to be remediated (see Table 8.1). Matrix types include sandy soils, clay soils, chemical residues and debris (construction debris, non-intact drums, etc.). Material that has been described as chemical residues includes the inorganic material disposed in the Lime Sludge Disposal Area, material that has been described as iron waste and wastewater treatment solids. The physical and chemical characteristics of these materials influence the identification of applicable and effective alternatives.

The three (3) criteria described above are considered in the development of alternatives included in this FS. Because of the variation of types of materials, types of contaminants and different locations within the source areas at the Site, each alternative, except for No Further Action, consists of more than one technology.

Table 8.2 provides an aid for the development of remedial alternatives for the Site. The table lists applicable and potentially effective technologies by type of material that will be remediated. The applicability and effectiveness of each technology to a material type is evaluated based on the technology's ability to achieve the established Preliminary Remediation Goals (PRGs) for that material. Any effective alternative would address all of the materials listed in the first column, because each alternative is intended to address the entire Site, and developed alternatives do so by combining technologies. Note that the table includes only the remedial technologies listed on Table 8.2, and does not include No Further Action.

Key factors considered in the development and subsequent evaluation of remedial alternatives for the Site are:

1. PRGs have been developed for the sources at the Site (Section 6.0). However, because of the OU-1 groundwater remedy and access restrictions on the Site, no risk to the public currently exists.

2. The location of some contaminants restricts the applicability of some technologies. For example, this was discussed above for the case of contaminants below the water table.

3. Some contaminants within the same class (organics or inorganics) are not equally treatable by all technologies. For example, nitrobenzene is easily biodegraded while 1,2,3-trichloropropane is difficult to biodegrade.

4. In general, metals and organics are not effectively treated by the same methods.

Assumptions made in developing the alternatives listed below and evaluated in the FS are:

1. Each alternative is designed to address the PRG for each source area.

2. Except for the No Further Action Alternative and Monitored Natural Attenuation, the PRGs are satisfied by each developed alternative. The former alternative is required by regulation to be carried through the evaluation process.

3. Alternatives cover a range of options from no further action to *ex situ* remediation.

Table 8.2

Applicable Technologies by Type of Material

Material Type	Monitored Natural Attenuation	Capping	Hydraulic Capture	Subsurface Vertical Barrier	In situ Bioremediation	In situ Stabilization	Land Disposal	Ex situ Bioremediation	On-site Thermal	Off-site Incineration	Ex situ Stabilization
Unsaturated Zone											
Organics											
Sandy Soils	X	X			X		X	X	X	X	
Clayey soils	X	X					X	X	X	X	
Iron Filings material		X					X	X	X	X	
Wastewater treatment solids		X					X	X	X	X	
Debris		X					X				
Inorganics											
LSD Material		X				X	X			X	X
Wastewater treatment solids		X				X	X			X	X
Saturated Zone											
Organics											
Sandy Soils	X		X	X	X						
Clayey soils	X		X	X							

4. Except for No Further Action, all alternatives include the excavation and subsequent treatment of the drums in the Stacked Drum Area. A commitment has already been made by Ciba and EPA to remove the intact drums from the Drum Disposal Area.

8.2 List of Alternatives

Each of the alternatives developed for the Site is described in this subsection.

To facilitate the presentation of the alternatives listed below and to eliminate the necessity of the repetitive discussion of technologies that would meet PRGs, due to the number and variety of source areas and retained response actions and technologies, simplifying assumptions were made. The assumptions are:

1. In the case of the No Further Action Alternative, no active remediation is considered.

2. The Monitored Natural Attenuation Based and Containment Based Remediation alternatives include the removal of the drums in the Stacked Drum Area.

3. The only remediation technology types that survived the technology screening (Section 7.0) for saturated zone materials are containment and *in situ* bioremediation. Where *ex situ* treatment technologies are specified for the unsaturated zone (includes perched water zones that can be dewatered prior to excavation), *in situ* bioremediation and containment were specified for the saturated zone materials to comply with PRGs. Containment only was specified for the saturated zone in the Containment Based Remediation alternative.

4. Hydraulic control was specified as the only containment alternative for the saturated zone (taken here to mean the Primary Cohansey saturated zone). The groundwater extraction and recharge system (GERS) already provides hydraulic containment of the plume.

5. Three (3) on-site, *ex situ* treatment based alternatives were considered for materials contaminated by organic COCs that comply with PRGs. These were: 1) one that makes exclusive use of on-site, *ex situ* thermal remediation of those materials; 2) one that makes exclusive use of *ex situ* biotreatment; and: 3) one that specifies the use of both technologies in some combination.

6. The off-site remediation based alternative was developed under the assumption that no on-site, *ex situ* treatment will occur and that disposal on-site will not be available. In all other alternatives where disposal is specified, disposal will be on-site or off-site, as appropriate.

The alternatives developed for the source areas are:

1. Alternative 1, No Further Action

2. Alternative 2, Monitored Natural Attenuation Based Remediation

3. Alternative 3, Containment Based Remediation

4. Alternative 4, On-site Thermal Treatment Based Remediation

5. Alternative 5, Biotreatment Based Remediation

6. Alternative 6, Off-site Remediation Based Alternative

7. Alternative 7, Combination Alternative

8.2.1 REMEDIAL ACTIONS COMMON TO TWO OR MORE ALTERNATIVES

1. **Hydraulic Containment:** In all alternatives, the GERS will be operational until aquifer restoration is achieved or until Monitored Natural Attenuation is applicable to support the shut down of part or all of the GERS. Also, the GERS will be optimized to facilitate aquifer restoration in all alternatives.

2. **Drum Removal:** All alternatives, except for No Further Action, include the removal of the stacked drums in the Stacked Drum Area and the treatment or disposal of their contents. The drums will be excavated and inspected individually in the field. The drums were in relatively good condition in 1992 when they were last inspected during a test pit investigation. Drums found to be leaking or unsuitable for transfer will be placed in a container. The drums will be moved expeditiously to a staging area and then into a building for opening and inspection. Any leaking or suspect drums will be moved directly into the building. Inside the building the drums will be opened, inspected and segregated according to disposal plans. To the extent feasible, drum contents will be bulked with similar material prior to treatment or disposal.

The types of drummed waste and their treatment/disposal options are:

1) Resin filter cake (no solvent)	8500 drums	Landfill
2) Resin filter cake (with solvent)	8500 drums	Biotreatment; On-site Thermal
3) Dye residue (with solvent)	8000 drums	Off-site Incineration
4) Dye residue (no solvent)	1000 drums	Landfill; Off-site Incineration
5) AQ soot and filter bags	1000 drums	Off-site Incineration
6) Solid resin	1500 drums	Landfill
7) Bricks and concrete	750 drums	Landfill
8) Lab waste	1000 drums	Off-site Incineration
9) Copper oxide residue	600 drums	Landfill
10) Cuno filters/pit drains/irganox	1000 drums	On-site Thermal; Landfill

Note: The above estimates are based on plant records kept regarding the numbers of drums disposed by type of waste contained (Forms E-150 and E-149).

3. **Perched Water Management:** In all alternatives, except for No Further Action and Monitored Natural Attenuation Based Remediation, perched water management in the Drum Disposal Area, Filter Cake Disposal Area and Former South Dye Area is included. These sources are underlain by the Cohansey Yellow Clay. The objective of perched water management is to eliminate water flow through the soil above the Yellow Clay and the Yellow Clay itself. By reducing or eliminating this flow, the mass flux from residual contamination in the Upper Cohansey sand and Yellow Clay is also reduced or eliminated. Perched water management makes use of physical control (slurry walls or interception trenches) to prevent on-flow of perched groundwater from upgradient areas, as well as hydraulic control (wells or collection trenches) to collect perched water within the source areas. Collection trenches or wells are generally placed in downgradient or downslope locations. Caps are also used to prevent percolation of rainwater through the soil and to prevent mass flux to the aquifer in that way. Following excavation and backfilling of the Stacked Drum Area, a cap will be installed over the area to prevent percolation of precipitation through residual contamination remaining in this and neighboring subareas.

4. ***In situ* Bioremediation:** In all alternatives, except for No Further Action, Monitored Natural Attenuation and Containment Based Remediation, material within the saturated zone exceeding PRGs (Equalization Basins) will be remediated by *in situ* bioremediation and hydraulic containment.

8.2.2 ALTERNATIVE DESCRIPTIONS

1. Alternative 1, No Further Action: This alternative assumes that no action is taken in the source areas other than the systems that are currently in place. In place systems are the GERS, in which hydraulic containment of sources is achieved, caps over the Drum Disposal Area and Lime Sludge Disposal Area and institutional controls (i.e., fencing) that are currently active at the Site (Table 8.3). Also, because the waste disposed in the Lime Sludge Disposal Area has been stabilized, stabilization is also considered a part of the current system.

2. Alternative 2, Monitored Natural Attenuation Based Remediation: This alternative includes the elements in the No Further Action Alternative, with the additional key feature of the application of monitored natural attenuation to groundwater and all sources (Table 8.4). A description of Monitored Natural Attenuation and how it is implemented at a site is described in Section 7.2.5.

   The drums in the Stacked Drum Area will be excavated and the drum contents and associated contaminated soils appropriately treated or disposed (off-site thermal or off-site disposal for non-hazardous materials). The procedure for handling the drums is described in Section 8.2.1. A cap will be placed in the Filter Cake Disposal Area to address any potential surface soil risks. Sections of the Lime Sludge Disposal Area, in which samples do not pass the Toxicity Characteristic Leaching Procedure (TCLP) test for arsenic (if any), will the stabilized in this alternative.

3. Alternative 3, Containment Based Remediation: This alternative includes hydraulic and physical containment (primarily capping) of the source areas (Table 8.5). The sources to which physical containment (caps and/or vertical barriers) would be applied are the Non-Intact Drum Area, Stacked Drum Area, the Iron Filings Area and the Eastern Area of the Drum Disposal Area, Standpipe Burner Area, Filter Cake Disposal Area, Equalization Basins, Former South Dye Area, Former Building 108/Underground Storage Tank Area, and the Backfilled Lagoon Area. The caps currently in place in the Drum Disposal Area and Lime Sludge Disposal Area will be upgraded or replaced, as necessary.

Hydraulic containment of all sources is implemented in this alternative. Hydraulic containment is focused on the Primary Cohansey Member, with wells installed, as appropriate (see Section 8.2.1). Perched water management is also part of this alternative, as described in Section 8.2.1. Sections of the Lime Sludge Disposal Area, in which samples do not pass TCLP for arsenic (if any), will be the stabilized in this alternative. Stabilization of portions of the Northern and Southern Sludge Drying Lagoons of the Backfilled Lagoon Area is also included, for the purpose of increasing the stability of this area for cap installation and related construction activities. The drums in the Stacked Drum Area will be addressed in this alternative, as described in Section 8.2.1, with the exception that on-site treatment or on-site disposal are not available in this alternative. Following excavation of the drums, clean fill will be brought to the Stacked Drum Area, and the area will be graded and capped.

4. Alternative 4, On-Site Thermal Treatment Based Remediation: In this alternative, on-site thermal treatment will be applied to all organic contaminated material that requires treatment based on PRGs in the unsaturated zone sources (Table 8.6). For the purpose of remedial alternatives definition, the unsaturated zone includes the zone of perched water above the Yellow Clay and Yellow Clay. Sources are the Non-Intact Drum Area, Stacked Drum Area and Iron Filings Area of the Drum Disposal Area, Standpipe Burner Area, Trench Disposal Area, Filtercake Disposal Area, Equalization Basins, Former South Dye Area, Former Building 108/Underground Storage Tank Area, Borrow Compactor Area and the Backfilled Lagoon Area. Material, particularly debris, excavated from the Non-Intact Drum Area, Stacked Drum Area and the Trench Disposal Area that are contaminated yet do not require thermal treatment will be decontaminated and appropriately disposed.

   The drums in the Stacked Drum Area will be excavated and the drum contents and associated contaminated soils appropriately treated or disposed. The drums will be handled as described in Section 8.2.1, except that on-site *ex situ* bioremediation will not be applied.

   Material requiring remediation within the saturated zone (Equalization Basins) will be remediated by *in situ* bioremediation and hydraulic containment (Section 8.2.1). Perched water management, as described in Section 8.2.1, will also be part of this alternative in the south plume source areas (Drum Disposal Area, Standpipe Burner Area and Filtercake Disposal Area) and Former South Dye Area in the north plume. The Lime Sludge Disposal Area is capped to prevent percolation of water through this area.

Treatment residues from the on-site thermal treatment process meeting applicable standards will be used on-site as fill. Treatment residues from the Backfilled Lagoon Area and Filtercake Disposal Area that fail TCLP for metals will be stabilized. This stabilized material will also be used as fill. Areas into which this fill will be placed are those excavated during the remediation.

5. Alternative 5, Biotreatment Based Remediation: In this alternative, on-site, *ex situ* biotreatment (composting) will be applied to material requiring treatment based on PRGs in the unsaturated zone in the source areas (Table 8.7). As described for alternative 4, the unsaturated zone includes the zone of perched water above the Yellow Clay and the Yellow Clay. These source areas are the Non-Intact Drum Area, Stacked Drum Area and Iron Filings Area of the Drum Disposal Area, Standpipe Burner Area, Trench Disposal Area, Filtercake Disposal Area, Equalization Basins, Former South Dye Area, Former Building 108/Underground Storage Tank Area, Borrow Compactor Area and the Backfilled Lagoon Area. Material that can be excavated, requires treatment and is inappropriate for *ex situ* bioremediation will be sent off-site for treatment (i.e., incineration) or disposal. Material, particularly debris, excavated from the Non-Intact Drum Area, Stacked Drum Area and the Trench Disposal Area, that is contaminated, will be decontaminated and appropriately disposed.

   The drums and their contents will be handled as described in Section 8.2.1, except as follows. Those drums that are appropriate for biotreatment will undergo on-site, *ex situ*, biotreatment (see Section 8.2.1). On-site thermal treatment is not available for treatment of drums in this alternative.

   Material within the saturated zone that requires treatment based on PRGs (Equalization Basins) will be remediated by *in situ* bioremediation and hydraulic containment (see Section 8.2.1). Perched water management, as described in Section 8.2.1 above, will also be part of this alternative in the south plume source areas (Drum Disposal Area, Standpipe Burner Area and Filtercake Disposal Area) and Former South Dye Area in the north plume. The Lime Sludge Disposal Area is capped to prevent percolation of water through waste in this area. Sections of the Lime Sludge Disposal Area, in which samples do not pass TCLP for arsenic (if any), will the stabilized in this alternative. Treatment residues (from on-site treatment only) will be addressed in the same manner as described for the residues of thermal treatment in Alternative 4 above.

6. Alternative 6, Off-Site Remediation Based Alternative: In this alternative, material in the source area unsaturated zones, as defined in alternative 4, that requires treatment based on PRGs will be excavated and transferred to an off-site treatment facility or disposed in an off-site landfill (Table

8.9). The source areas are the Non-Intact Drum Area, Stacked Drum Area and Iron Filings Area of the Drum Disposal Area, the Standpipe Burner Area, Trench Disposal Area, Filtercake Disposal Area, Equalization Basins, Former South Dye Area, Former Building 108/Underground Storage Tank Area, Borrow Compactor Area and the Backfilled Lagoon Area. Materials disposed in an off-site landfill are those neither requiring treatment or for which it is not appropriate, such as for some types of construction debris or inert, non-hazardous material. An assumption made in the development of this alternative is that on-site disposal or treatment is not available.

The drums and their contents will be handled as described in Section 8.2.1, except as follows. Drum contents requiring treatment will be incinerated off-site. Contents not requiring treatment will be landfilled off-site.

Material within the saturated zone requiring treatment based on PRGs (Equalization Basins) will be remediated by *in situ* bioremediation and hydraulic containment (see Section 8.2.1). Perched water management, as described in Section 8.2.1, is also part of this alternative in the south plume source areas (Drum Disposal Area, Standpipe Burner Area and Filtercake Disposal Area) and the Former South Dye Area in the north plume. The Lime Sludge Disposal Area is capped to prevent percolation of water through this area. Sections of the Lime Sludge Disposal Area, in which samples do not pass TCLP for arsenic (if any), will be stabilized, *in situ*, in this alternative. There will be no treatment residues to handle in this alternative. Clean fill will be brought on site to bring all excavations to grade.

7. Alternative 7, Combination Alternative: This alternative was developed from the assumption that both on-site, *ex situ* thermal and biotreatment will be used for the material most suited for each technology in order to meet PRGs. The use of both technologies allows optimum treatment of materials on-site based on their physical and chemical characteristics (Table 8.9). Off-Site treatment and disposal are also used for the appropriate materials in this alternative. The source areas are the Non-Intact Drum Area, Stacked Drum Area and Iron Filings Area of the Drum Disposal Area, the Standpipe Burner Area, Trench Disposal Area, Filter Cake Disposal Area, Equalization Basins, Former South Dye Area, Former Building 108/ Underground Storage Tank Area, Borrow Compactor Area and the Backfilled Lagoon Area.

   The determination of which excavated material from the unsaturated zone sources, exclusive of the stacked drums, is suitable for which treatment follows. Material contaminated with primarily

biodegradable organic COCs, at low to moderate concentrations, will be treated by *ex situ* biotreatment. Material contaminated with primarily organic COCs at relatively high concentrations and/or with relatively high proportions of organic compounds that are recalcitrant, will undergo on-Site thermal treatment. Material, particularly debris, excavated from the Non-Intact Drum Area, Stacked Drum Area and the Trench Disposal Area that are contaminated, will be decontaminated and appropriately disposed. The drums in the Stacked Drum Area and their contents will be handled just as described in Section 8.2.1.

Perched water management, as described in Section 8.2.1, is also part of this alternative in the south plume source areas (Drum Disposal Area, Standpipe Burner area and Filter Cake Disposal Area) and Former South Dye Area in the north plume. Material in the saturated zone requiring treatment based on PRGs (Equalization Basins), will be remediated by *in situ* bioremediation and hydraulic containment (see Section 8.2.1). The Lime Sludge Disposal Area is capped to prevent percolation of water through this area. Sections of the Lime Sludge Disposal Area, in which samples do not pass TCLP for arsenic (if any), will be stabilized, *in situ*, in this alternative. Treatment residues (from on-site treatment only) will be addressed in the same manner as described for the residues of thermal treatment described in Alternative 4 above.

Table 8.3

Alternative 1: No Further Action

Response Action	No Action	Monitored Natural Attenuation	Containment			In Situ Treatment		Ex Situ Treatment			On-Site Disposal	Off-Site Treatment	Off-Site Disposal
AREA			Cap	Vertical Barriers	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site					X								
DDA (Non-Intact Drum Area)			I		X								
DDA (Stacked Drum Area)			I		X								
DDA (Iron Filings Area)			I		X								
DDA (Eastern Area)					X								
Standpipe Burner Area					X								
Filtercake Disposal Area/ Trench Disposal Area					X								
Lime Sludge Disposal Area			I		X		I						
Equalization Basins					X								
Former South Dye Area					X								
Former Building 108/UST Area					X								
Backfilled Lagoon Area					X								
Fire Prevention Training Area					X								
Casual Dumping Area					X								
Borrow Compactor Area					X								
Casual Dumping Area					X								
East Overflow Area					X								
Wastewater Treatment Plant Area					X								

I = Refers to systems currently in place. No additional action to be taken under this alternative.

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

Table 8.4

Alternative 2: Monitored Natural Attenuation Based Remediation

Response Action	**No Action**	**Monitored Natural Attenuation**	**Containment**			**In Situ Treatment**		**Ex Situ Treatment**			**On-Site Disposal**	**Off-Site Treatment**	**Off-Site Disposal**
AREA			Cap	Vertical Barriers	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site		X			X								
DDA (Non-Intact Drum Area)		X	I		X								
DDA (Stacked Drum Area)		X	I		X							X	X
DDA (Iron Filings Area)		X	I		X								
DDA (Eastern Area)		X			X								
Standpipe Burner Area		X			X								
Filtercake Disposal Area/ Trench Disposal Area		X	X		X								
Lime Sludge Disposal Area		X	I		X		X						
Equalization Basins		X			X								
Former South Dye Area		X			X								
Former Building 108/UST Area		X			X								
Backfilled Lagoon Area		X			X								
Fire Prevention Training Area		X			X								
Casual Dumping Area		X			X								
Borrow Compactor Area		X			X								
Casual Dumping Area		X			X								
East Overflow Area		X			X								
Wastewater Treatment Plant Area		X			X								

I = Refers to systems currently in place.

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

Table 8.5

Alternative 3: Containment Based Remediation

Response Action	No Action	Monitored Natural Attenuation	Containment			In Situ Treatment		Ex Situ Treatment			On-Site Disposal	Off-Site Treatment	Off-Site Disposal
AREA			Cap	Vertical Barriers (1)	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site					X								
DDA (Non-Intact Drum Area)			X		X								
DDA (Stacked Drum Area)			X		X							X	X
DDA (Iron Filings Area)			X		X								
DDA (Eastern Area)			X		X								
Standpipe Burner Area			X	X	X								
Filtercake Disposal Area/ Trench Disposal Area			X	X	X								
Lime Sludge Disposal Area			X		X		X						
Equalization Basins			X		X								
Former South Dye Area			X	X	X								
Former Building 108/UST Area			X		X								
Backfilled Lagoon Area			X		X		X (2)						
Fire Prevention Training Area					X								
Casual Dumping Area					X								
Borrow Compactor Area					X								
Casual Dumping Area					X								
East Overflow Area					X								
Wastewater Treatment Plant Area					X								

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

1. Vertical barriers include slurry walls or interception trenches for the management of perched groundwater

2. Stabilization in Backfilled Lagoon Area (Northern and Southern Sludge Drying Lagoons) to support caps and construction activities.

Table 8.6

Alternative 4: On-Site Thermal Treatment Based Remediation

Response Action	**No Action**	**Monitored Natural Attenuation**	**Containment**			**In Situ Treatment**		**Ex Situ Treatment**			**On-Site Disposal**	**Off-Site Treatment**	**Off-Site Disposal**
AREA			Cap	Vertical Barriers (1)	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site					X								
DDA (Non-Intact Drum Area)			X		X				X		X (2)		
DDA (Stacked Drum Area)			X		X				X		X(2)	X	X
DDA (Iron Filings Area)			X		X				X				
DDA (Eastern Area)			X		X								
Standpipe Burner Area			X	X	X				X				
Filtercake Disposal Area/ Trench Disposal Area			X	X	X				X		X(2)		
Lime Sludge Disposal Area			I		X		X						
Equalization Basins					X	X			X				
Former South Dye Area			X	X	X				X				
Former Building 108/UST Area					X				X				
Backfilled Lagoon Area					X				X				
Fire Prevention Training Area					X								
Casual Dumping Area					X								
Borrow Compactor Area					X				X				
Casual Dumping Area					X								
East Overflow Area					X								
Wastewater Treatment Plant Area					X								

I = Refers to systems currently in place with no anticipated change..

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

1. Vertical barriers include slurry walls or interception trenches for the management of perched groundwater

2. Debris disposal

Table 8.7

Alternative 5: Biotreatment Based Remediation

Response Action	No Action	Monitored Natural Attenuation	Containment			In Situ Treatment		Ex Situ Treatment			On-Site Disposal	Off-Site Treatment	Off-Site Disposal
AREA			Cap	Vertical Barriers (1)	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site					X								
DDA (Non-Intact Drum Area)			X		X			X			X(2)		
DDA (Stacked Drum Area)			X		X			X			X(2)	X	X
DDA (Iron Filings Area)			X		X			X					
DDA (Eastern Area)			X		X								
Standpipe Burner Area			X	X	X			X					
Filtercake Disposal Area/ Trench Disposal Area			X	X	X			X		X	X(2)		
Lime Sludge Disposal Area			I		X		X						
Equalization Basins					X	X		X					
Former South Dye Area			X	X	X			X					
Former Building 108/UST Area					X			X					
Backfilled Lagoon Area					X			X		X (3)			
Fire Prevention Training Area					X								
Casual Dumping Area					X								
Borrow Compactor Area					X			X					
Casual Dumping Area					X								
East Overflow Area					X								
Wastewater Treatment Plant Area					X								

I = Refers to systems currently in place, with no anticipated change

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

1. Vertical barriers include slurry walls or interception trenches for the management of perched groundwater

2. Debris disposal

3. Stabilization in Northern and Southern Sludge Drying Lagoons of Backfilled Lagoon Area

Table 8.8

Alternative 6: Off-Site Remediation Based Alternative

Response Action	**No Action**	**Monitored Natural Attenuation**	**Containment**			**In Situ Treatment**		**Ex Situ Treatment**			**On-Site Disposal**	**Off-Site Treatment**	**Off-Site Disposal**
AREA			Cap	Vertical Barriers (1)	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site					X								
DDA (Non-Intact Drum Area)			X		X							X	X
DDA (Stacked Drum Area)			X		X							X	X
DDA (Iron Filings Area)			X		X							X	X
DDA (Eastern Area)			X		X								
Standpipe Burner Area			X	X	X							X	X
Filtercake Disposal Area/ Trench Disposal Area			X	X	X							X	X
Lime Sludge Disposal Area			I		X		X						
Equalization Basins					X	X						X	X
Former South Dye Area			X	X	X	X						X	X
Former Building 108/UST Area					X	X						X	X
Backfilled Lagoon Area					X							X	X
Fire Prevention Training Area					X								
Casual Dumping Area					X								
Borrow Compactor Area					X							X	X
Casual Dumping Area					X								
East Overflow Area					X								
Wastewater Treatment Plant Area					X								

I = Refers to systems currently in place, with no anticipated change.

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

1. Vertical barriers include slurry walls or interception trenches for the management of perched groundwater

Table 8.9

Alternative 7: Combination Remedial Alternative

Response Action	**No Action**	**Monitored Natural Attenuation**	**Containment**			**In Situ Treatment**		**Ex Situ Treatment**			**On-Site Disposal**	**Off-Site Treatment**	**Off-Site Disposal**
AREA			Cap	Vertical Barriers	Hydraulic Capture	Biological	Stabilization	Biological	Thermal	Stabilization		Incineration	
Entire Site					X								
DDA (Non-Intact Drum Area)			X		X			X	X		X (2)		
DDA (Stacked Drum Area)			X		X			X	X		X (2)	X	X
DDA (Iron Filings Area)			X		X			X	X				
DDA (Eastern Area)			X		X								
Standpipe Burner Area			X	X	X			X	X				
Filtercake Disposal Area/ Trench Disposal Area			X	X	X			X	X	X	X (2)		
Lime Sludge Disposal Area			I		X		X						
Equalization Basins					X	X		X	X				
Former South Dye Area			X	X	X			X	X				
Former Building 108/UST Area					X			X	X				
Backfilled Lagoon Area					X			X	X	X (3)			
Fire Prevention Training Area					X								
Casual Dumping Area					X								
Borrow Compactor Area					X			X	X				
Casual Dumping Area					X								
East Overflow Area					X								
Wastewater Treatment Plant Area					X								

I = Refers to systems currently in place, with no anticipated change.

Note: Hydraulic capture is effected by GERS operation. Includes future optimization of GERS

1. Vertical barriers include slurry walls or interception trenches for the management of perched groundwater

2. Debris disposal

3. Stabilization in Northern and Southern Sludge Drying Lagoons of Backfilled Lagoon Area